



# CDM in a Distributed Environment

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# Introduction

- If you don't know where you're going, you will most likely end up somewhere else.
- Objective:
  - Produce the same results (output) consistently
  - Given the same input and parameters



# Configuration Management (CM)

- EIA-649
  - A management process for establishing and maintaining consistency of a product's performance, functional, and physical attributes with its requirements, design, and operational information throughout its life.



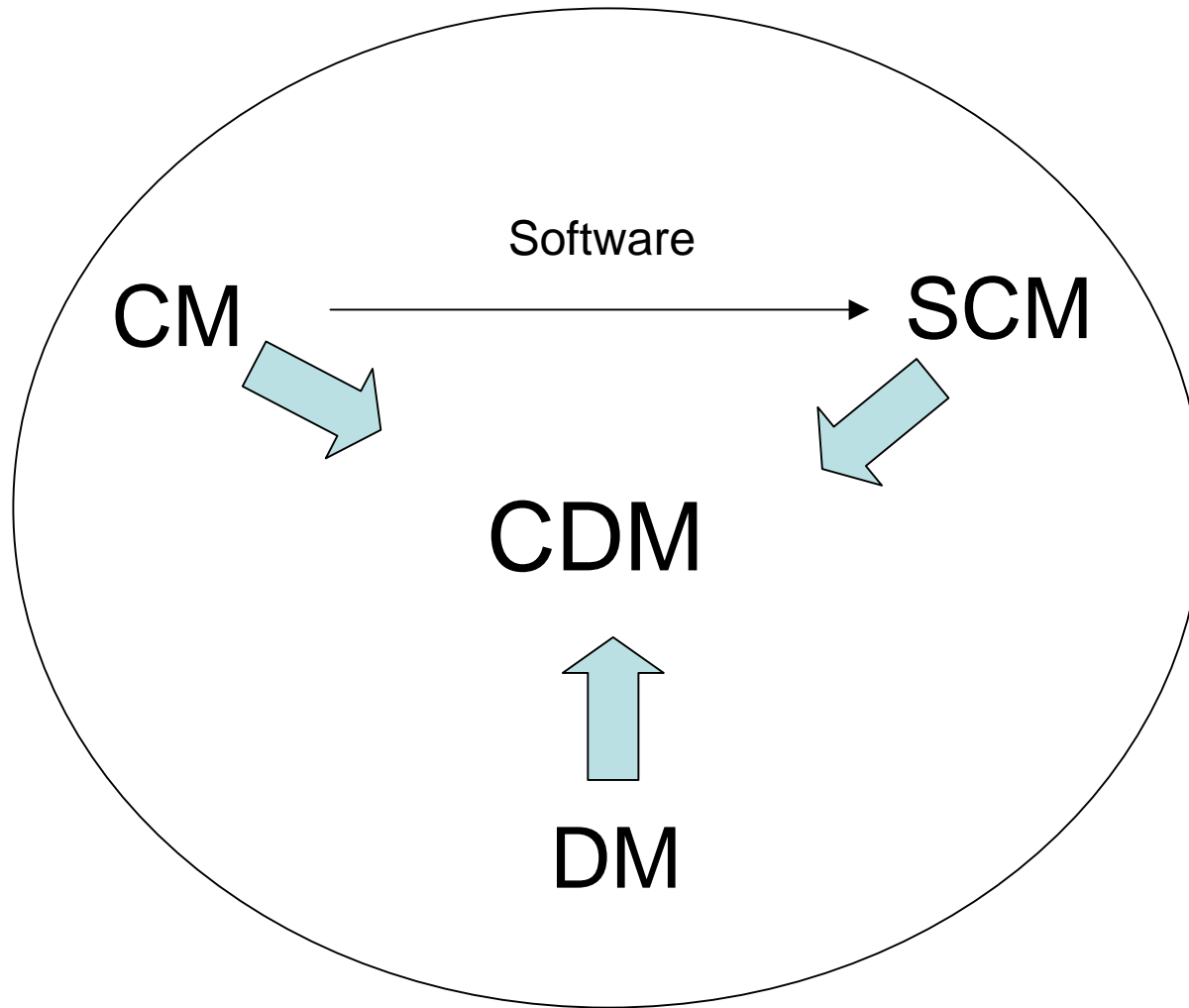
# Data Management (DM)

- GEIA-859, draft
  - Consists of the disciplined processes and systems that plan for, acquire, and provide stewardship for product and product-related business data, consistent with requirements, throughout the product and data life cycles.



# CDM

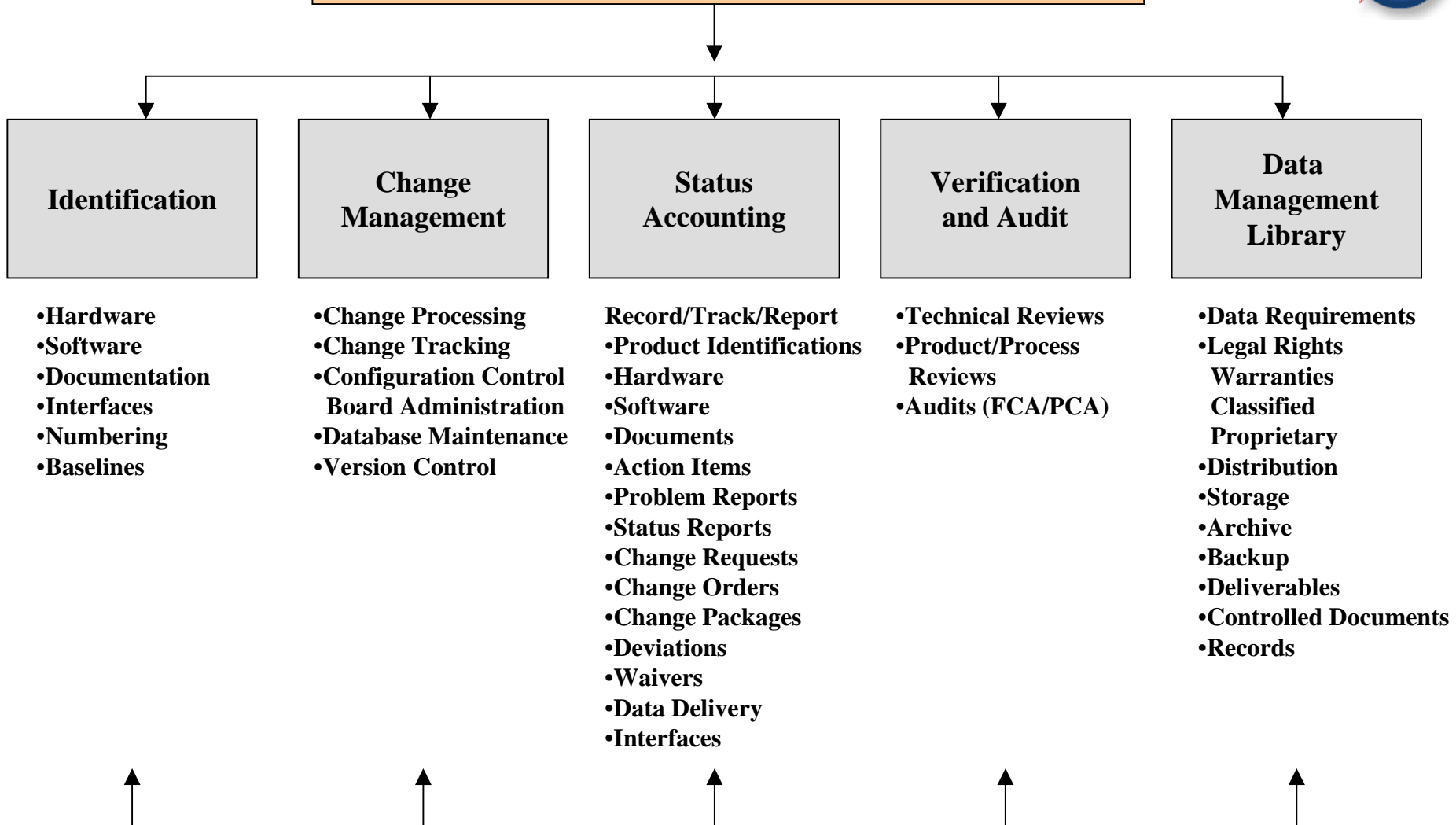
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# Configuration and Data Management Activities





# CDM (continued)

- CM controls
  - Performance and physical/functional attributes of the product
  - Hardware produced by the Project team
- SCM controls
  - Code produced by development team
  - Test results produced by the test team
- DM controls
  - Documentation produced by the Project team
  - Data produced by the Project team
- Provides link to Records Management
  - Controls records produced by the Project team





# CDM (continued)

- Configuration and Data Management (CDM) is not commercial-off-the-shelf (COTS) install and go
  - Decisions need to be made upfront
    - CM policies/procedures need to be planned and documented
      - Identification, change management, status accounting, verification, tracking, ...
    - SCM policies and procedures need to be planned and documented
      - Branching strategy, promotion policy, directory structure, ...
    - DM policies/procedures need to be planned and documented
      - Data modeling, relationships, document trees, forms development, review, baseline, notifications, distribution, access, ...



# AEE Project (Space Launch Initiative)

- Develop toolset capable of evaluating the emerging launch vehicle technologies from the viewpoints of performance, feasibility, cost, safety, risk, and reliability.
- Deliver an advanced engineering environment with life-cycle and performance models capable of modeling technology, performance, safety, reliability, cost, and risk.
- Integrate products into a sequence of capability builds that are tested and validated by and for customers.



# AEE and CDM

- CDM on one software tool at one location is challenging
- Implementing CDM on 23+ configuration items (CIs) demands solutions on a different order of magnitude
- NASA's Space Launch Initiative (SLI) Advanced Engineering Environment (AEE) Project provides
  - Environment to test application of CDM principles at complex level
  - CDM disciplines provide stability to complex environment



# AEE CDM Objectives

- Establish and maintain CDMOPs to define “how” the CDM principles are applied
- Identify product attributes as a basis for control
- Document product configurations as a basis for making changes to increase reliability and predictability
- Uniquely identify configuration items to facilitate traceability throughout the product life cycle
- Manage change activities using an approved Configuration Control process for all configuration items and baselines
- Identify, track, and report changes made to product baselines
- Ensure that changes are approved, recorded, and formally incorporated in all controlled products
- Conduct audits and reviews of AEE products and processes to verify product configurations and change history
- Establish a secure repository of information for AEE hardware, software, and documentation
- Organize CDM data for ease of access and retrieval to facilitate the management decision making process



# CDM in Distributed Environment

- CDM is challenging when confined to one location
- Implementing CDM activities across a distributed computing environment and across the Agency increases the level of difficulty
  - Firewall issues
  - Export control issues
  - Culture, missions, ethics
  - Contracting, agency, and center procedures
- One NASA
  - Environment to apply CDM principles at complex level
  - CDM disciplines provide stability to complex environment



# Life Cycle Process Model— Challenge

- Align CDM with project's life cycle process model
  - Reflect level of process maturity appropriate to risk associated with end product(s)
  - The more mission-critical (loss of life and/or potential for serious injury) a system, the more mature the life cycle model
  - Research center versus mission-critical, flight operations center
  - Products produced and system used to produce products are unique to the objectives of the center
  - Center culture becomes evident in organizational formation, lines of authority and accountability, and producing system



# Life Cycle Process Model— Lessons Learned

- Implement CDM early in project life cycle
  - Provides technical/programmatic insight into project
  - Timely planning, identification, and control of all project products (versus after-the-fact capture of artifacts)
  - Identify and establish appropriate processes to mitigate project risks
  - CDM Team can be proactive (versus reactive)



# CDM Plan—Challenge

- CDM Plan development within a culture-diverse team
  - Obstacles
    - Culture/environment/terminology differences
    - Experience base of the distributed team members
    - Processes previously used by the team members
  - Good mechanism
    - Level the team's experiences
    - Reach a common understanding of the approach needed to meet the project's CDM requirements
  - CDM requirements
    - Endorsed early by the Project Manager
    - Specified in the project's high-level documentation
    - Carry no less weight than technical requirements





# CDM Plan—Lessons Learned

- Effective CDM implementation calls for direct accountability to the highest project authority
  - Visibility into CDM activities
  - Succinct lines of communication
  - Unambiguous reporting structure for CDM team members
- Disciplined approach required to implement CDM in a distributed environment
  - Culture and geographical differences
  - Diversity of business goals for a particular site or center
  - Consensus between centers that is supported by all



# CDM Plan—Lessons Learned (continued)

- CDM Plan needs to reflect common understanding of CDM elements by all CDM personnel
  - Follow a widely accepted standard (EIA/Mil-Std/IEEE/NASA)
    - Credible, best practices approach to the CDM planning activities
    - Decisions on tools to facilitate the CDM and SCM activities
    - Change authorities for proposed changes to baseline products
    - CDM procedure documentation and approval
  - Communicated to management for buy-in and approval
  - Approval by Project Manager prior to implementation
  - Authorizes CDM activities at the proper level
  - Prevents misconceptions and false starts of the CDM process



# CDM Tools—Challenge

- Selection of effective tools to facilitate CDM activities
  - Establish CDM tool requirements
    - Meet needs of distributed environment
      - Multiple development and test platforms
      - Multiple users in multiple locations
      - Varying experiences and knowledge base
      - Multiple tools with multiple access issues
      - Geographical-based vendor alliances
    - Consider usability issues and buy-in from users
      - Reduces risk during implementation
      - Increased likelihood of user acceptance of the CDM tools and methods.
    - Maintain intent of CDM objectives
  - Define upfront *all* technical and programmatic requirements that impact tool selection



# CDM Tools—Lessons Learned

- Establish tool requirements
  - Meet needs of the distributed environment
  - Do NOT compromise intent of CDM objectives
  - Reduces risk during implementation
  - Consider usability issues and buy-in from users
  - Provides user acceptance of CDM tools/methods



# Communication—Challenge

- Team communications in a distributed environment
  - Good communication is discriminator between
    - Complete, accurate, and correct products/processes
    - Products/processes that fall short of customer expectations
  - Effective CDM communication includes
    - User-specific training of process theory and terminology
    - Process details
    - How tools are used to facilitate these processes
  - Communication of CDM requirements must begin with highest project authority (Project Manager)
    - Empowers CDM team to continue to communicate detailed implementation activities across organizational elements
  - Creatively use today's technology to keep team members well-informed



# Communication— Lessons Learned

- Communication
  - Identify team members and develop team atmosphere
  - Develop mechanisms to keep all team members plugged-in
    - Distribution lists for each functional element
    - Centralized location for meeting minutes and records
    - Easy access to project data supports the interaction among team members required to facilitate proposed change impact analysis and assessments
    - Utilize available technical assets to communicate and distribute information
  - Identify and provide relevant, up-to-date, training for all team members' training needs



# Conclusions

- The more things change, the more they stay the same
  - CDM disciplines provide glue to hold project and products together
  - Greater need exists in distributed environment
  - Greater distance between project members and products
- It's the same problem
  - Implementation prior to requirements definition and design is a bad idea—in any discipline
  - Basic principles should not be compromised—especially, when it is the right thing to do
- Standardized CDM requirements and processes
  - Define/establish early in the project
  - Implement mature CM/SCM and DM processes
  - Supported by project management
  - Provide basis for clear, concise, and valid project information
  - Maintain project information as accurate and useful



# Conclusions (continued)

- AEE CDM Team has formed from distributed group of individuals
  - Flow process developed/updated to match project activities' changes
  - CDM Plan draft meets industry/project standards
  - CDM tool requirements have been gathered
  - Existing CDM tools being reevaluated
- SCM has been applied to AEE efforts
  - Not as early as desirable
  - Products have been “tested” in real time by users/developers prior to placement under control
  - Need to understand the impacts of changes and process more proactively in research-type of environment
  - Processes need to be fully documented and applied
- DM is currently in the planning process
  - Document Review Process
  - Document Tree
- Much progress made, much to be done





# Final Conclusion

Change will happen

CDM will enable you to  
identify, document, control,  
account, verify, and access it